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July 26, 2001

Ms. Magalie Salas, Secretary  
Federal Communications Commission  
445 12th Street SW  
Washington DC 20554

**Re: ET Docket No.98-153 -- Revision of Part 15 of the Commission's Rules Regarding  
Ultra-Wideband Transmission Systems**

Dear Ms. Salas:

Pursuant to Section 1.1206(a)(2) of the Commission's Rules, on behalf of XtremeSpectrum, Inc., I am filing this letter electronically to report an oral ex parte communication in the above-referenced proceeding.

Yesterday, Martin Rofheart and John McCorkle of XtremeSpectrum, Inc. and I met with Julius P. Knapp, Karen Rackley, and John A. Reed of the Commission staff. During the meeting, we reiterated the views expressed in XtremeSpectrum's written ex parte statement filed yesterday. A copy of our presentation outline is attached.

If there are any questions about this filing, please call me at the number above.


Respectfully submitted,

Mitchell Lazarus  
Counsel for XtremeSpectrum, Inc.

cc: Meeting participants


***XtremeSpectrum, Inc. Presentation to OET  
25 July 2001***

**XtremeSpectrum, Inc.  
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(703) 269-3000**




## *Proposed Regulations*



- **XSI's recommended measures to protect other users:**
    - steep emission mask (see below);
    - indoor-only operation;
    - test to reduce spectral lines in the GPS band
      - ♦ 10 kHz RBW; power limit 10 dB below the 1 MHz limit)
    - improved measure of peak-to-average ratio.
  
  - **For details, see XSI's filing of April 25, 2001.**
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## ***Aggregation Effects are Not a Threat to GPS***

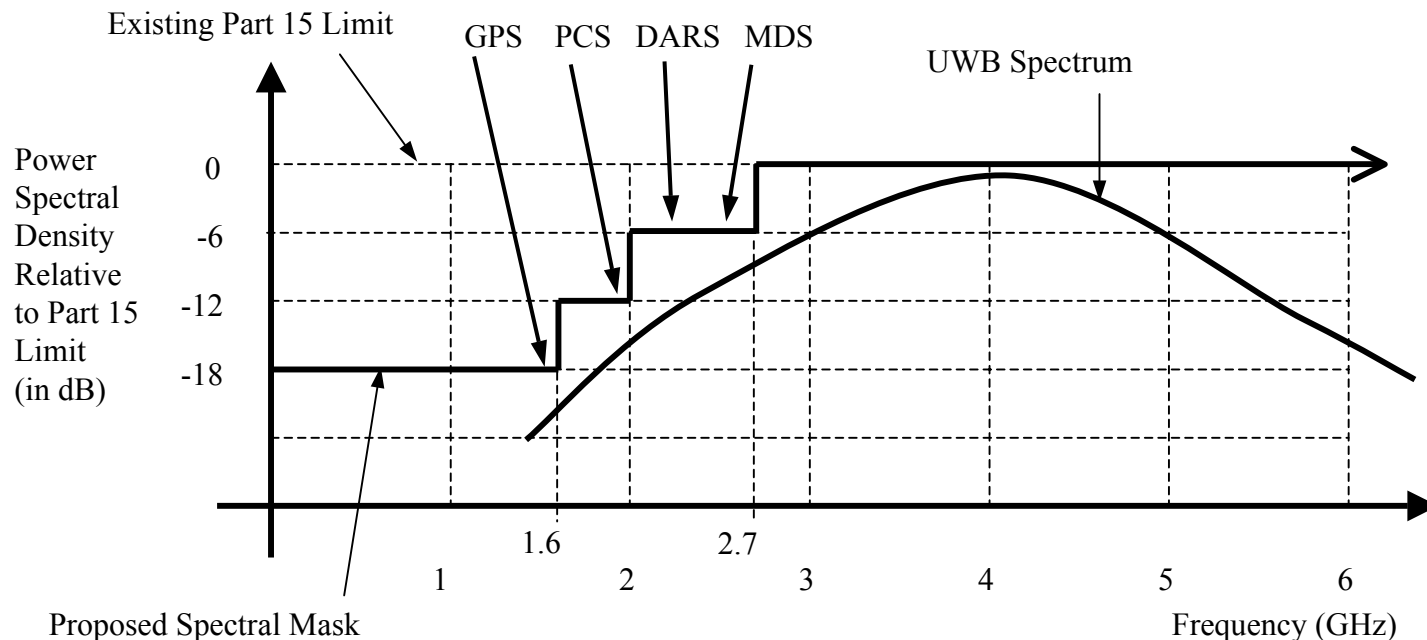


- **Aggregation effects will not cause significant interference.**
  - ***Short range*** : Devices closer than about 10 meters share a common RF channel, and must reduce power, duty cycle, or both to function properly.
  - ***Longer range***: Indoor UWB signals propagate poorly, so signals from devices more than about 10 meters apart cannot add significantly.
  - **The specter of multiple, nearby UWB emitters all operating simultaneously at full power cannot come to pass.**
  - ***There is less interference from an office building with hundreds or thousands of UWB emitters than from 2.5 full-time UWB emitters at the same distance as the nearest emitter.***
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## Simple Illustration Showing UWB Emissions Do Not Aggregate

WPAN #	Range to Victim Receiver m	Power received by Victim Receiver picowatt/MHz	% of total energy received by victim receiver	Accumulated Power Received By Victim Receiver	Location of WPANs
1	3	0.029506	90.957	0.029506	Net in same room
2-18	7	0.001880	5.796	0.031386	17 Nets, 8 in adjacent rooms (left, right, above, below, left-above, right-above, left-below, right-below) PLUS 9 across the hall
19-50	11	0.000580	1.789	0.031966	32 Nets 16 in 2nd adjacent Rooms + 16 across hall
51-98	15	0.000252	0.776	0.032218	48 Nets, 24 in 3rd adjacent rooms + 24 across hall
99-162	19	0.000130	0.402	0.032348	64 Nets 32 in 4th adjacent rooms + 32 across hall
163-242	22	0.000091	0.280	0.032439	80 Nets 40 in 5th adjacent rooms + 40 across hall
Total Interference = .032439 picowatts/MHz = -104.9 dBm/MHz = 1.099 times the power from the closest emitter					

## A Spectral Mask to Regulate UWB Emissions



- Mask efficacy is unaffected by whether UWB signals are deemed “intentional” or “out-of-band.”
- Mask is consistent with GPSIC requests in other proceedings (Docket No. 99-67 (filed July 21, 1999); Docket No. 99-168 (filed Feb. 22, 2000)).
- Mask is consistent with RTCA Paper No. 086-01/PMC-139 And RTCA SC-159

## ***A Spectral Mask to Regulate UWB Emissions (2)***




- **XSI clarifies that its emissions outside the -10 dB bandwidth are out of band**
  - The NPRM proposes using the -10 dB points to define UWB occupied bandwidth.
- **XSI's -10 dB bandwidth runs from 2.5 to 8 GHz, and contains more than 97% of the total transmitted energy.**



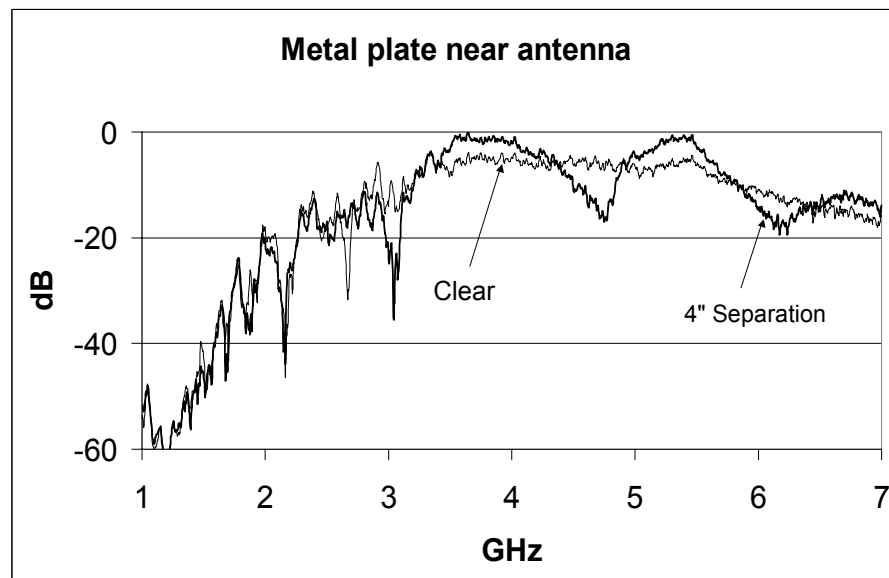
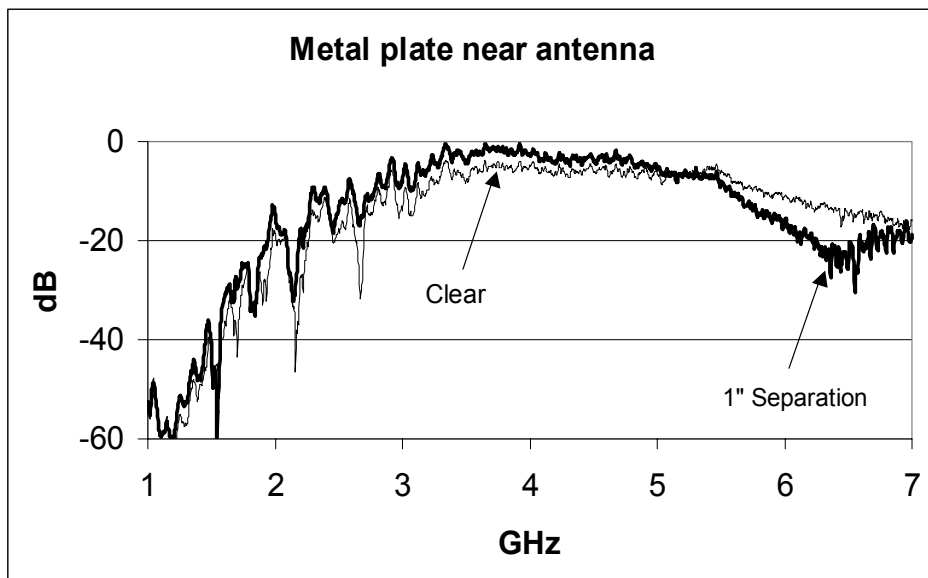
## ***Antenna Manipulations are Not a Threat to GPS***



- **UWB is not inherently susceptible to large spectral deviations caused by antenna manipulations.**
  - **XSI's antenna cannot be deformed without breaking it. It is printed on a rigid substrate.**
  - **Theory and measurements show that neither antenna manipulations nor nearby metal can significantly alter XSI's emissions near the GPS bands.**
    - The pattern of an electrically small antenna is broad no matter how it is bent, so gain will not increase.
    - Bending or manipulating the antenna will degrade it's performance in the UWB system.
    - There is, therefore, a built-in deterrent for a user to modify the antenna.
  - ***The Commission will not certify a device that the user can easily take out of compliance.***
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## Antenna Manipulations are Not a Threat to GPS (2)



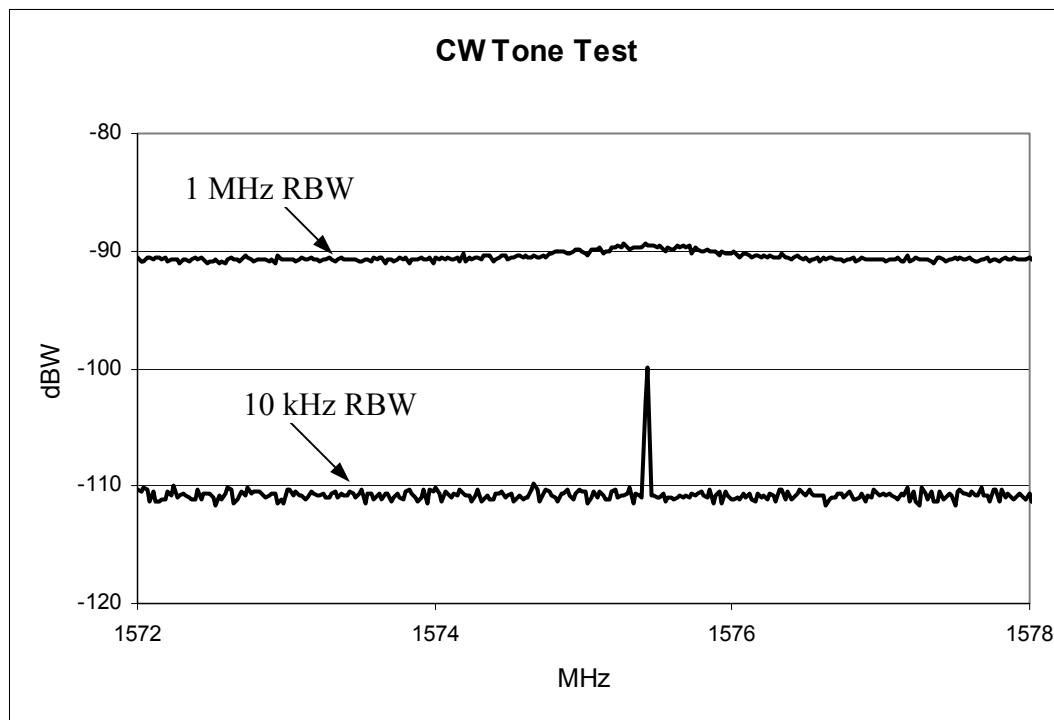
- Measured using a Rohde & Schwarz ZVM Vector Network Analyzer (VNA)
- Shows in-room multipath in addition to multipath effects from 3" by 6" steel plate 1" or 4" away.

## ***Proposed Test for UWB Spectral Lines***



- **XSI's original proposal: 30 kHz RBW; 15 dB additional suppression below levels specified for a 1 MHz RBW (GPS band only)**
  - **GPSIC proposal: 10 KHz RBW; 10 dB additional suppression.**
  - **XSI accepts and endorses the GPSIC alternative.**
  - **References that support the 10 dB higher sensitivity of GPS C/A-code receivers to CW-like interference:**
    - *NTIA Special Publication 01-45, Assessment Of Compatibility Between Ultrawideband Devices And Global Positioning Systems Receivers, February, 2001, section 4.1.3*
    - *RTCA Paper No. 086-01/PMC-139, Second Interim Report to the Department of Transportation: Ultra-Wideband Technology Radio Frequency Interference Effects to Global Positioning System Receivers and Interference Encounter Scenario Development, RTCA SC-159, 27 MAR 2001, section 4.1.1.2*
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## Proposed Test for UWB Spectral Lines (2)



- Measured using a Rohde & Schwarz ESI-26 EMI test receiver/spectrum analyzer
- A CW signal 10 dB below broadband noise is easily identified.

## ***Causes of Spectral Lines Are Irrelevant***




- **A device that passes the spectral-line test has shown it does not generate spectral lines that could interfere with GPS.**
- **It is unimportant from a regulatory standpoint how the device achieves the test standard.**
  - There are many ways to remove or reduce spectral lines.
- **The Commission should follow its traditional approach of setting performance criteria, and letting industry decide how best to meet them.**



## *The GPS Front-End Filter*




- **GPS front-end filters cannot generate new spectral lines or other harmful interference from UWB noise signals.**
  - **Noise going into a filter also comes out as noise (reshaped by the filter pass band).**
  - **Even if GPS front-end filtering delays and stretches UWB pulses, the superposition of noise is still noise.**
  - **The effect of GPS front-end filtering is similar to multipath, and equally harmless to GPS.**
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## *Indoor UWB Operations in “Glass” buildings*

- The body of scientific literature shows that using 9 dB for an average building loss factor is not an overstatement, even when considering buildings with mostly glass exteriors.
- Example of one reference: Davidson and Hill made over 60,000 measurements at each of two frequencies for variety of locations in 10 medium sized buildings. The average loss was found to be 10.8 dB ( $\sigma=5.8$ ) at 900 MHz and 10.2 dB ( $\sigma=5.6$ ) at 1500 MHz. They describe the buildings as: “A large percentage of the [outer] building surface is glass, which is typical of the newer construction in the area”.
- Indoor use helps to protect most GPS and DARS users, and all federal systems tested.
- Even buildings whose outer surface is mostly glass help to protect outdoor GPS from indoor UWB devices.
- Only a fraction of a glass-exterior building consists of window opening.

## *Indoor GPS Operations*



- **UWB emissions (at XSI levels) will not hinder indoor E911 assisted GPS even in the absence of other RF sources.**
  - **GPSIC comments stated A-GPS needs an “interference-free” environment where all RF interference is at or below thermal noise.**
    - This is not possible, with or without UWB.
    - In practice, RF from other sources such as computers, fluorescent lights, motors, copiers, printers, elevators, etc. will completely drown out the UWB signal. Digital devices are allowed to radiate 75 times more power than XSI proposes
    - In a real-world RFI environment, UWB emissions in the GPS bands will be literally lost in the noise..
  - **Additional processing gain of 20-30 dB provided by A-GPS techniques provide ample margin against UWB emissions for indoor A-GPS operation.**
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## ***Assisted-GPS E911 RFI Link Budget for a High Density Office Building***

Parameter	Budget	Comments
Minimum SV signal in clear, dBm	-130	GPS specification
Building penetration loss, dB	-9 to -20	NTIA and US GPSIC
GPS signal interior of building, dBm	-139 to -150	
Standard GPS processing gain, dB	43	
Detection margin, dB	-12	
Signal equivalent level, dBm	-108 to -119	
Assisted-GPS processing gain, dB	20 to 30	US GPSIC, FAA
Signal equivalent level, dBm	-78 to -99	
XSI limit @GPS freq, dBm/MHz	-59.3	18 dB below -41.3 dBm/MHz
Public Safety Margin, dB	0	Not defined for terrestrial applications
Multiple System Allotment, dB	0	Not defined for terrestrial applications
GPS antenna gain toward RFI, dB	0	
Separation distance, meters	3	Distance to closest emitter
Propagation loss, dB	-46	
Single emitter allotment	0.6	Assumes: 100% activity factor, max. power, separate offices with 9 dB wall loss, 20 dB ceiling/floor loss.
Bandwidth Correction factor, dB	3	
UWB level at GPS receiver, dBm	-101.7	Noise-like signal. However, the 10 dB CW deficit is covered by the spectral line test
Carrier-to-noise margin	23.7 to 2.7	Positive Margin for A-GPS operation



## *Conclusion*



- **Properly regulated UWB will not interfere with GPS.**
    - UWB that is safe for GPS will fill important public needs.
  - **The Commission should move forward promptly to authorize UWB.**
  - **XSI's proposals are all anticipated in the NPRM, and do not require a Further Notice.**
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